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STUDY OF HARIABILITY AND GENETIC ADVANCE IN BARLEY (*HORDEUM VULGARE* L.) ON AFFECTED SOIL

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ABSTRACT

Much progress has been made through plant breeding in term of developing improved gremplasm with tolerance to major abiotic and biotic stresses, good quality and adaptation to different growing conditions and production system. A 60 entries including varieties, and genotypes and conducted in two consecutive year. The material was made on 17 characters that included two physiological and 15 quantitative charasters in both the years. The estimate of heritability serves as a useful guide to the breeder. The breeder is able to appreciate the proportion of variation the is due to Genotypic (Broad sense heritability) or additive (Narrow sense heritability) effect that is the heritable portion of variation in the first case and the portion of genetic variation that is pure line in the later case.

INTRODUCTION

Barley is one of the major important cereal crops of the word and is a major source of food for large number of people living in the cooler, semi – arid area of the word. In India barley is grown on large scale in Uttar Pradesh, Rajasthan, Bihar, M.P., Haryana and Punjab that make about 80 percent of total barley area of the country. Lush (1940, 1943, 1949) indicates two types of heritability. (1) Heritability in broad sense (2) Heritability in narrow sense. Trehen *et al.*, (1970a, b) observed high estimates of heritability in broad sense and genetic advance as percent of mean for tillers per plant, peduncle length, ear length and grain yield per plant. Sethi *et al.*, (1972) working in hulled barley reported that yield per plant, plant height, number of tillers per plant, grains per plant, days to flowering and test weight showed high heritability (h^2), GCV, PCV and GA. The regression analysis indicated that tillers per plant contributed about 75% of total variability for yield. Osam (1985) reported that narrow-sense heritability estimates for harvest index (HI) ranged from 0.22 to 0.34 and were 3 or 4 times higher than heritability for grain yield and biomass. Adanski *et al.*, (1996) observed that heritability coefficient appeared to be highest for 100-grain weight (80%) and protein content (83.3%), while for fine malt extract and fine-coarse difference the value of this parameter were rather low (48.2 and 59.6% respectively). Bichonski (2003) observed that heritability was high for 1000-grain weight, diastatic power and soluble protein of malt. EI-Bawab (2003) studied six barley genotypes crossed in all possible combinations excluding reciprocals. The yobserved that heritability value were high for all the traits. However narrow sense heritability values were high for 100 kwt (70%), Gy/p (67.16%), SL (66.67%) and SKW (63.73%) and moderate for remaining trails. Ozbas and Cagrgan (2004) studied 16 barley mutuant genotypes and obtained the highest broad-sense heritability estimate (91%) for root weight regarding relationships among the traits. The strongest correlation was obtained the longest root length and total length.

AI-Yessin *et al.*, (2005) observed that broad-sense heritability in the individual year-location combinations varied from 0 to 0.68 and both the simple correlation and the rank correlation coefficient between grain yield and heritability were not significant. Mohammadi *et al.*, (2006) studied 158 double haploid barley at 2 locations for drought tolerance. Highest heritability was obtained for 1000-kernal weight, followed by days to heading in both environments, indicating that these traits are controlled by additive gene effect. Foe *et al.*, (2007) reported heritability values to be higher than 87% for all methods. Results indicated that barley hardiness is influenced by both genotype and environment and that trait is heritable, which allow breeders to develop very hard soft varieties if required.

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MATERIALS AND METHODS

The experiment was conducted in two years on saline-alkali soil under late sown conditions at Agricultural Research Farm of ShriDuurgaJi Post Graduate College, Chandeshwer, Azamgarh. The material for present investigation were 60 varieties/strains selected from germplasm available in the Department of Genetics and Plant Breeding Banaras Hindu University, Varanasi. Experiment was conducted in a Randomized Block Design with three replications. In the experiment row to row spacing was 30 cm and plant to plant was 10 cm.

Statistical Analysis

Heritability

It was calculated in broad sense according to the formula suggested by Hanson, Robinson and Comstock (1956).

$$\text{Heritability (\%)} = \frac{\text{Genotypic Variance } (\sigma^2 g) \times 100}{\text{Phenotypic variance } (\sigma^2 p)}$$

Genetic Advance:

Expected genetic advance under selection was calculated according to Johanson *et al.*, (1955).

$$\text{G.A} = \frac{(\sigma^2 g)}{(\sigma^2 p)} \times \sqrt{\sigma^2 p} \times K$$

K = Selection differential (a constant) and its value being 2.06 at 5% selection intensity.

$$\text{Genetic advance (\% of mean)} = \frac{\text{G. A.} \times 100}{X}$$

RESULTS AND DISCUSSION

In the present investigation broad heritability was estimated for various traits in year-I and year-II pooled over environment. In the year-I (2007-2008) estimates broad sense heritability showed that it was high for all the characters (above 70%). Grain per spike showed highest heritability (98.8%). Genetic advance was also high (above 30%) for 9 characters. The highest genetic advance was recorded for grain for yield/plant (98.78%).

In the year-I, high heritability along with high genetic advance was observed for grains per spike (98.8%), grain yield per plant (94.7%), width of flag leaf (94.4%), length of awn (90.1%), width of second leaf (89.3%), length of flag leaf (89.9%), spike length (86.7%), earbearing tillers (85.1%), peduncle length (84.9%), grain length (84.3%), second leaf length (82.4%), tillers per plant (80.4%), days to maturity (78.1%) and grain width (72%). In year-II (2008-09) 15 characters had high heritability. The highest heritability estimate was recorded for number of grains/spike (99.0%) but the highest genetic advance was observed in the character grain yield per plant (101.10%). In the year-II high heritability coupled with high genetic advance was observed for number of grains/spike followed by grain yield per plant (97.7%), 100-grain weight (98.9%), plant height (92.9%), days to flowering (91.3%), peduncle length (91.2%), width of flag leaf (90.4%), length of spike (89.8%), width of second leaf (87.7%), awn length (86.6%), grain length (86.5%), days to maturity (86.2%), second leaf length (86.0%), flag leaf length (83.4%) and earbearing tillers (76.5%). High heritability along with low genetic advance was estimated for grain width. In pooled data, heritability estimates was highest for number of grains/spike (98.6%), but genetic advance was the highest for grain yield/plant (83.64%). In this study, high heritability along with high genetic advance was observed for number of grains per while high heritability along with low genetic advance was observed for days to maturity and grain length.

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Table 1: Estimates of different characters of barley (*Hordeum vulgare* L.) in year-I (2007-08), Year-II (2008-09) and pooled over year

Sl. No.	Characters	Year-1		Year-2		Pooled	
		Fraction	%	Fraction	%	Fraction	%
1.	Days to 50% flowering	0.943	94.3	0.913	91.3	0.919	91.9
2.	Days to maturity	0.781	78.1	0.862	86.2	0.736	73.6
3.	Plant height	0.914	91.4	0.929	92.9	0.890	89.0
4.	Total Tillers/ plant	0.804	80.4	0.657	65.7	0.409	40.9
5.	Ear bearing tillers/plant	0.851	85.1	0.765	76.5	0.540	54.0
6.	Length of flag leaf	0.889	88.9	0.834	83.4	0.759	75.9
7.	Width of flag leaf	0.947	94.7	0.904	90.4	0.904	90.4
8.	Length of second leaf	0.824	82.4	0.860	86.0	0.700	70.0
9.	Width of second leaf	0.893	89.3	0.877	87.7	0.849	84.4
10.	Peduncle length	0.849	84.9	0.912	91.2	0.838	83.8
11.	Length of spike	0.867	86.7	0.898	89.8	0.835	83.5
12.	Length of awn	0.901	90.1	0.866	86.6	0.844	84.4
13.	Number of grains/spike	0.988	98.8	0.990	99.0	0.986	98.6
14.	Length of grain	0.843	84.3	0.865	86.5	0.799	79.9
15.	Width of grain	0.720	72.0	0.674	67.4	0.235	23.5
16.	100-grain weight	0.941	94.1	0.989	98.9	0.934	93.4
17.	Grain yield/plant	0.947	94.7	0.977	97.7	0.950	95.0

Table 2: Estimates of correlation coefficient among different characters in barley (*Hordeum Vulgare* L.) in year-1 (2007-08)

S.N.	Source	DF	DM	PH	NTP	NEBT	LFL	WFL	LSL	WSL	PL	LS	LA	NGS	LG	WG	100 GW	GYP
1.	Days to 50% Flowering	r ^e	0.724	-0.80	-0.083	-0.170	-0.130	-0.090	-0.071	-0.143	-0.174	-0.042	-0.129	-0.006	-0.226	-0.032	-0.060	-0.034
		r ^g	-0.608	-0.50	0.269	-0.045	-0.381	-0.090	-0.601	-0.302	-0.323	-0.088	-0.081	-0.597	-0.089	-0.283	-0.104	-0.622
		r ^p	0.603*	-0.052	0.225	-0.056	-0.359**	-0.090	-0.536**	-0.288*	-0.305*	-0.083	-0.084	-0.576**	-0.101	-0.229	-0.102	-0.585**
2.	Days to Maturity	r ^e	-0.033	-0.067	-0.11	-0.010	0.014	0.0050	-0.062	-0.136	0.083	-0.075	0.003	0.205	-0.031	0.092	-0.080	
		r ^g	0.064	0.287	0.016	-0.232	0.046	-0.350	-0.120	-0.141	-0.220	-0.183	-0.567	0.180	-0.152	0.066	-0.643	
		r ^p	0.050	0.213	-0.007	-0.195	0.041	-0.280*	-0.110	-0.139	-0.167	-0.156	-0.497**	0.108	-0.122	0.067	-0.561**	
3.	Plant height	r ^e	0.086	0.160	0.117	0.217	0.277	0.108	0.340	0.199	-0.064	-0.011	0.001	0.022	0.074	0.225		
		r ^g	0.164	0.170	0.144	0.173	0.144	0.240	0.471	0.013	0.040	0.053	0.069	0.019	0.132	0.207		
		r ^p	0.152	0.168	0.141	0.175	0.159	0.227	0.454**	0.033	0.031	0.050	0.060	0.019	0.128	0.208		
4.	Total tillers /plant	r ^e	0.468	-0.133	0.069	0.040	-0.057	-0.043	-0.069	0.098	0.153	0.086	0.037	0.005	0.166			
		r ^g	0.84	-0.218	-0.231	-0.272	-0.268	-0.242	0.044	0.116	-0.297	-0.043	0.214	0.061	-0.011			
		r ^p	0.776**	-0.204	-0.194	-0.214	-0.235	-0.208	0.026	0.112	-0.257*	-0.020	0.172	0.054	0.008			

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Heritability studies were also made by several workers in barley such as, Sharma et al., (1983), Sanguinetti (1985), Tripathi (1989), Fregeau et al., (1996), Yadav et al., (2004), El – Bawab (2003) and Bichonski (2003), Fox et al., (2007), Kharizi et al., (2009).

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